

## ON THE USE OF FIXATION PLATES IN THE TREATMENT OF FRACTURES OF THE LEG.<sup>1</sup>

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THE universal recognition of the principle of antisepsis has brought about so great a change in the treatment of fractures of the leg, that, excepting for injuries of the severest type, primary amputation is no longer resorted to, and is rarely practised even in hospitals with a large accident service.

This spirit of conservatism has brought into general practice methods formerly employed by the boldest only, and in our day every effort is made to save a leg, no matter how severely it may be crushed, as long as the important blood-vessels and nerves remain intact to nourish the injured limb.

We are prepared to enlarge existing wounds or to make free incisions in order to gain access to the broken ends of the bones, remove fragments, blood clots, bundles of soft tissues which by their interposition prevent coaptation. Sutures, pegs, screws and staples are employed to retain the fragments in apposition to secure union of bone and usefulness of the injured leg.

The application of the Röntgen discovery to the uses of surgery has further expanded the field of conservatism in supplementing the known diagnostic signs by furnishing the means for direct inspection of the broken bones; it enables us to obtain far more reliable information about the direction and the character of the fracture, as well as the position of the fragments than is possible by surface inspection and palpation alone. We can turn the information thus obtained to the purpose of securing greater perfection in the result of the treatment.

It seems that this marvellous discovery has not been accorded its full merit, and it is yet contended that it usually affords

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no better information than can be obtained by inspection and touch. Our own experience, limited though it be, bids us to place the highest estimate upon the value of the skiagram. Even if owing to the direction from which the shadow is cast upon the plate, it at times fails to indicate the line of simple fracture without displacement, on the other hand it does not picture to us fractures, fragments and displacements unless these exist; and instances are not rare where the Röntgen rays have revealed conditions that were not previously recognized.

The danger of the mere possibility of failing to recognize improper apposition of the ends of a broken bone, ought itself make the employment of the Röntgen rays imperative. Viewed from this stand-point, the Röntgen rays become a vital factor in preventing deformity and in securing undiminished usefulness in cases of even severe and complicated fractures of one or both bones of the leg. The result of the treatment, based upon the well-known symptoms alone, and consisting of reduction, application of splints, pads, casts and the like, is generally satisfactory; exceptionally, however, deformity of various degrees with attendant impairment of usefulness of the limb ensues, and the sensation experienced by the surgeon when he views the skiagraphic picture of the malunited tibia, and the consciousness that the deformity might have been prevented if the exact condition had been recognized at the proper time, convert him to the belief held by those who appreciate that the Röntgen discovery has extended the field wherein active surgical interference in cases of fractures of the leg is indicated.

Whenever it is decided to cut down upon a broken tibia for the purpose of securing apposition of the fragments, various methods are available. Among these are,—wire sutures, ivory pegs, steel screws and staples. Our own experience has formerly been limited to the employment of silver wire, variously applied, and whilst it requires considerable disturbance of the soft tissues in drilling through both surfaces of the bone for introduction of the suture, the wire often becomes loose and fails to maintain the fragments in apposition.

Better success has been obtained by the application of a

silver plate in the form of a cleat to the flat subcutaneous surface of the tibia secured by small galvanized steel screws. The method is simple in its execution, does not complicate the treatment, is capable of maintaining the fragments in unyielding apposition, and thereby shortens the time required for bony union. Its employment has served to restore broken legs to unimpaired function without shortening. The plate which is designed to meet the indications of any fracture of the diaphysis of the tibia, transverse or oblique, single or multiple, is made of silver one-sixteenth of an inch in thickness, three and one-half inches in length, and three-fourths of an inch wide with perforations for the screws one-half inch apart. The patient being anæsthetized, an incision slightly exceeding the length of the plate is made through the integument along the median line of the inner surface of the tibia, its centre corresponding to the line of fracture when the bone is broken in one place only, or corresponding to the centre of an additional fragment. The integument is loosened laterally, the periosteum not being disturbed. After removal of serrations, spicules of bone, blood clots, soft tissue and other interposed or extraneous substances, the fragments are moulded into position, the plate adjusted, and the drill applied through such of the perforations as are selected for the reception of screws. The drill, slightly smaller than the diameter of the screws to be employed, is carried through the compact structure of the bone till cessation of resistance indicates that the medullary cavity has been reached.

Two screws are usually employed at each end and are secured by means of an ordinary screw-driver. Considerable force is occasionally required to overcome the tendency to displacement of one of the fragments, and has to be applied by the hands of an assistant.

In cases where infection exists or may be expected to supervene, a counter-opening on the posterior surface of the leg must be made and a drainage-tube inserted. Coexisting fracture of the fibula may exceptionally require attention; ordinarily it adjusts itself fairly well when the tibia is properly set. The integument is united over the plate by means of three or

four interrupted silkworm-gut sutures. The leg is now placed in a fracture-box or a posterior splint of metal or felt.

After the expiration of about one week the limb may be placed in a silicate of soda case, fenestrated over the position of the plate and over the drainage-tube if one has been inserted, and it may be safe to permit the patient to sit up in a rolling-chair or to be about on crutches. In the simpler cases the wound is apt to unite by first intention, although there is secretion of sanguinolent pus between the plate and integument that may require an opening in the line of the incision for its escape, and can be maintained patulous by a small gauze or rubber drain. The cases of comminuted fracture and cases with infection may demand irrigation which cannot be readily employed when the limb is incased in a silicate case, and it may be preferable to employ a fracture box.

We have found it convenient to practice massage of the affected limb in the third week after the receipt of the injury to prevent the swelling so liable to ensue in these cases. The plate seems to be a harmless tenant in the leg, and is permitted to remain in position until bony union has taken place. Its removal is accomplished with the aid of local anaesthesia alone. The screws are found to sit firmly in the osseous tissue. The following four illustrative cases represent as many varieties of injury to the shaft of the tibia and fibula or tibia alone.

**CASE I.**—Miss M. L. K., aged thirty-two years, on May 27th, 1897, while riding a bicycle came in collision with a moving electrical street car and was dragged along for some distance. Admitted to the Polyclinic Hospital on the same day. On examination a fracture of the right tibia below its middle with the upper fragment slightly protruding through the skin was recognized. Marked loss of blood. Leg was washed, placed in a fracture box, and an ice cap applied over wet bichloride gauze. June 3, swelling and pain subsided, reduction by extension and counterextension, application of silicate of soda case. June 8, a Röntgen ray photograph was taken through the case and revealed an oblique fracture of the right tibia about its middle with serrations and projecting spicules of bone, the upper fragment projecting forward and inward, overlapping to the extent of three-fourths of an inch. Fibula broken at the junction of upper

and middle third, upper fragment displaced outward, likewise overlapping to the same extent. (Fig. 1.) The case was removed, the patient anaesthetized, and reduction attempted with the aid of the fluoroscope; the fragments could not be brought into accurate apposition.

On the following day the patient was anaesthetized with ether, an incision made over the seat of the fracture along the inner surface of the tibia, the ends of the bone exposed, serrations removed by means of bone forceps, and silver plate three and one-half inches long placed over the periosteum secured in place by two screws at each end, integument united with silkworm-gut sutures. June 25, a small sinus at upper end of the wound leads down to the plate, slight discharge of pus. June 26, silicate of soda ease applied. June 28, patient left hospital. July 27, skiagraph taken through case shows good approximation of fragments and absence of firm callus. (Fig. 2.) August 17, plate removed under local ethyl chloride anaesthesia. Towards end of October discarded cane, is in excellent health. Two years later, October 28, 1899, skiagraph shows perfect union, lines of tibial fracture obliterated, that of fibula indicated by an oblique union of fragments. (Fig. 3.)

CASE II.—J. F., aged thirty-six years. Lahore in iron foundry. Admitted to the Polyclinic Hospital on June 25, 1898. While on an elevator this morning the sustaining rope broke, precipitating the cage in which he was standing to a distance of thirteen feet to the ground. The impact caused a fracture of both bones of the right leg about the junction of the middle with the lower third, a large irregular gaping wound, exposing the comminuted tibial fracture irregularly transverse, in direction with a square separate fragment driven into the soft tissues. The wound was irrigated, covered with wet bichloride gauze, the leg was placed in a fracture box and ice applied. Sedatives administered for relief of intense pain. Temperature on June 28, 99.2° F. June 29, temperature 102.6, morphine necessary. Good approximation impossible on account of comminution of bone, wound remains clean, constant irrigation with 1:4000 bichloride solution. Röntgen ray picture shows lateral displacement and loose fragments. (Fig. 4.) July 2, under ether anaesthesia a longitudinal incision over centre of inner surface of tibia down to the periosteum, the incision crosses the transverse wound of the leg, the broken ends of the tibia exposed. A large fragment replaced and a silver plate secured with two screws into the upper and two into the lower fragment (Fig. 5), suturing the incision and the wound in the integument over the plate with silkworm-gut. Wet bichloride gauze and a straight splint to

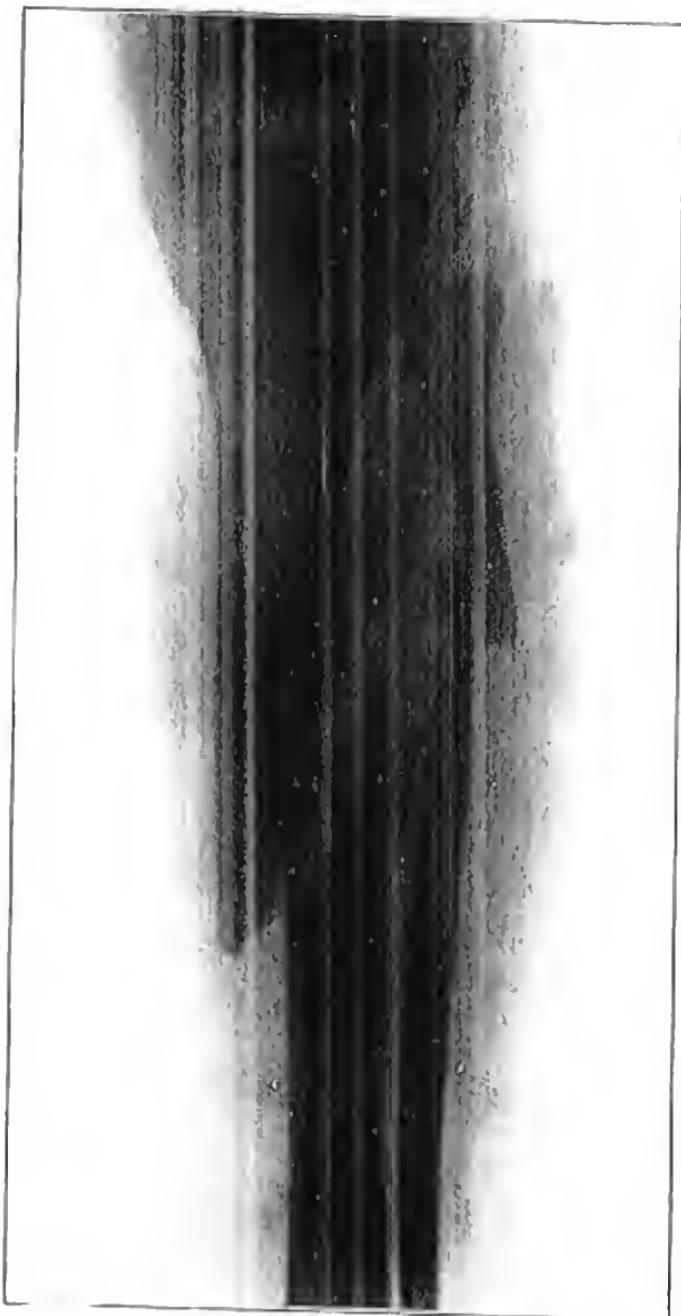


FIG. 1.—Showing broken tibia and fibula at different levels.

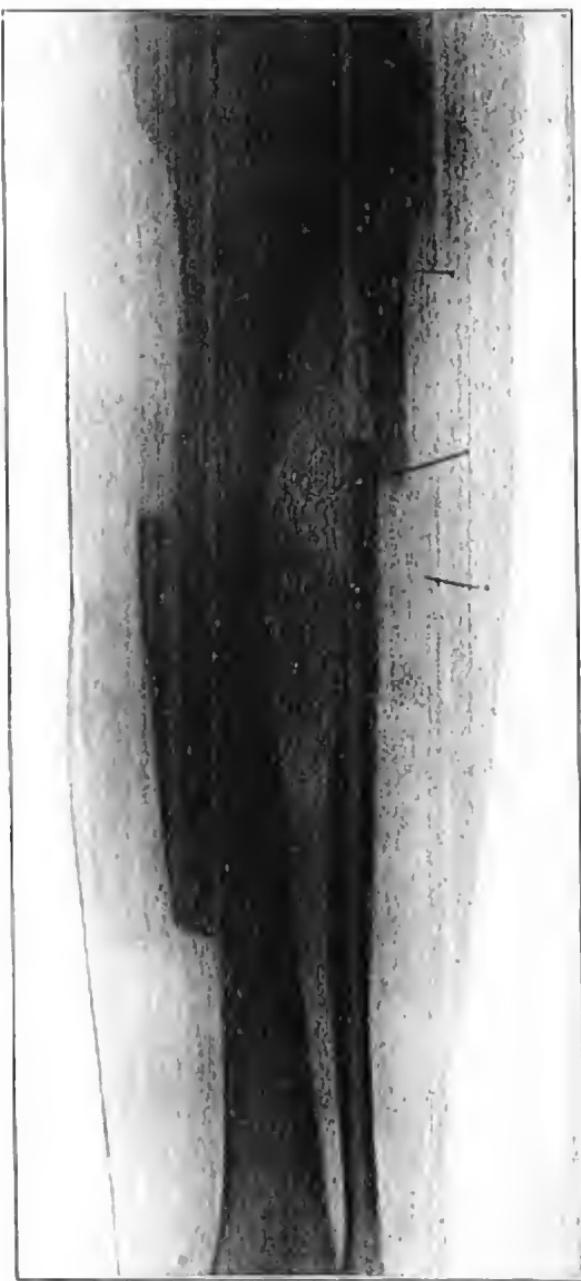


FIG. 2.—Showing good approximation and absence of firm callus.

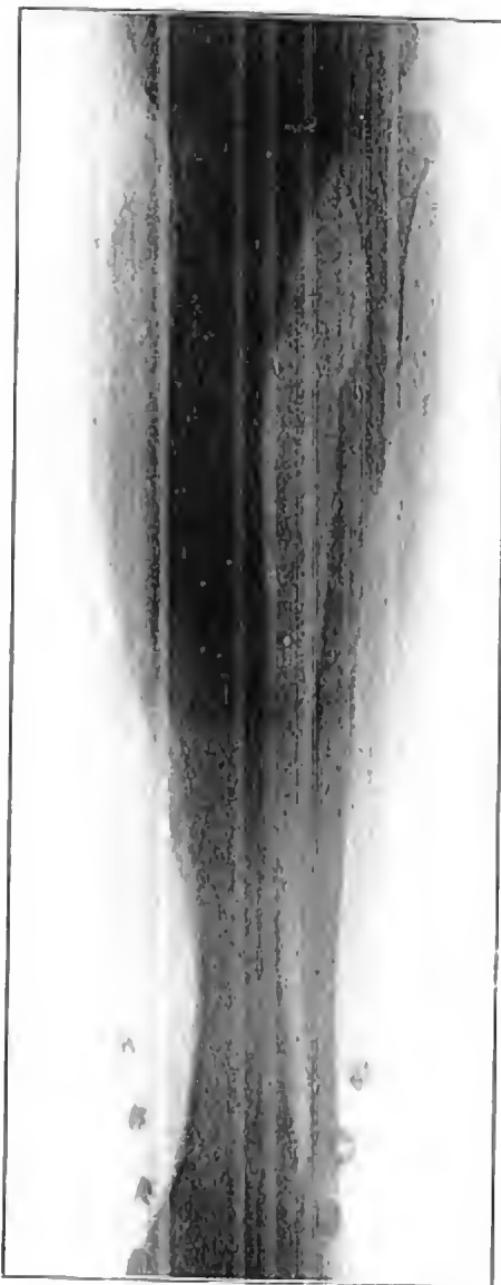


FIG. 3.—Perfect union, lines of tibial fracture obliterated.



FIG. 5.—Fragment replaced and silver plate secured with two screws in the upper and two into the lower fragment.



FIG. 4.—Showing lateral displacement and loose fragments.

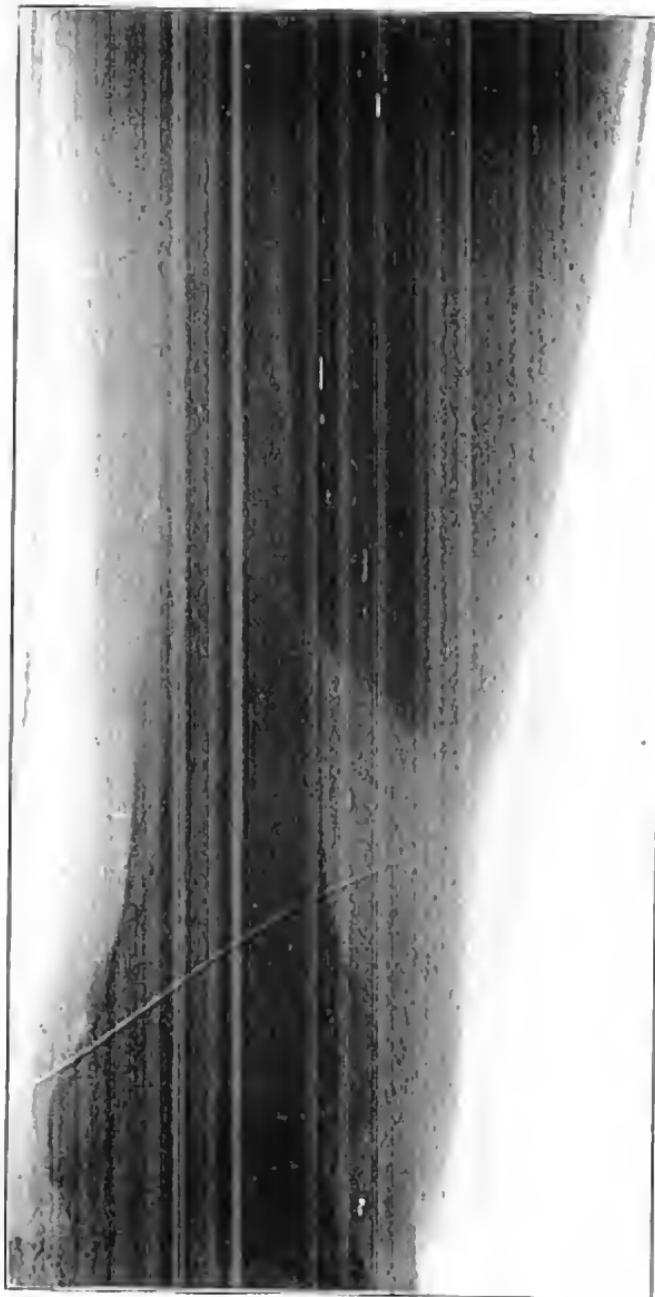


FIG. 6.—Showing fragments unapproximated.

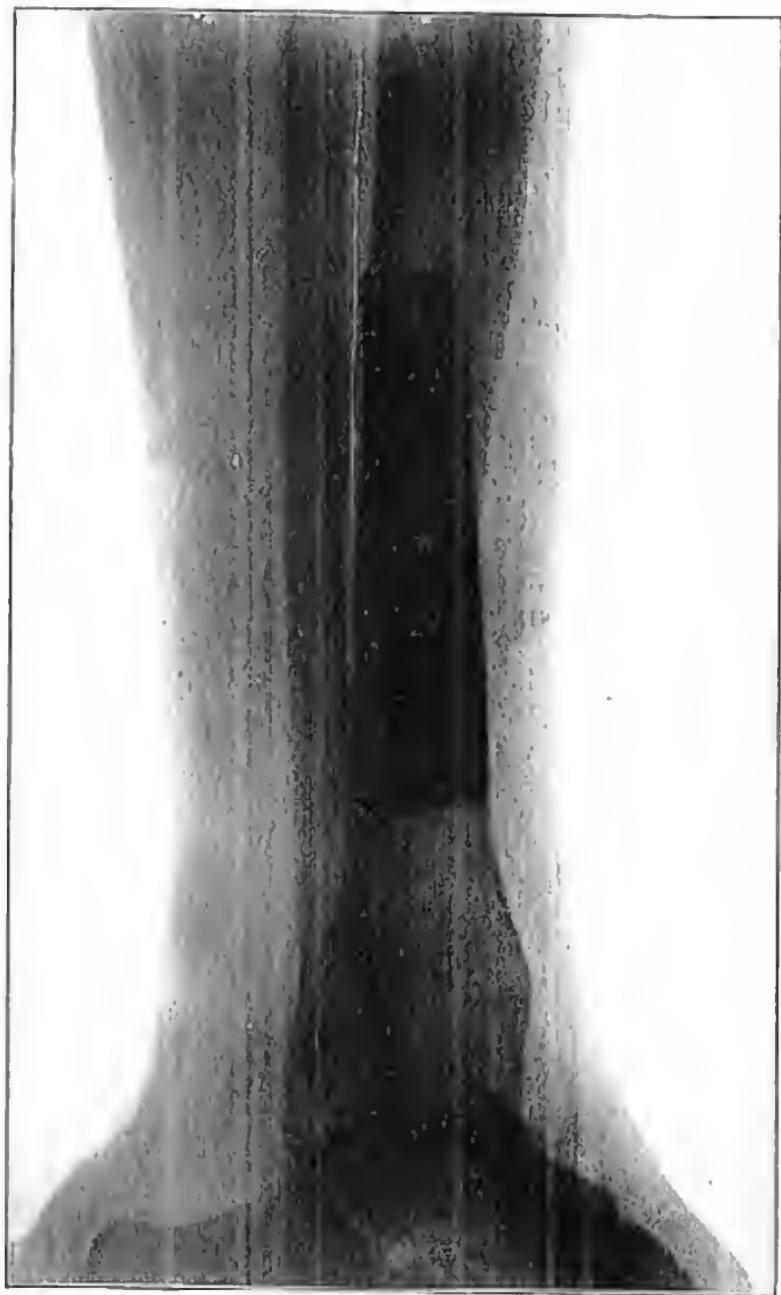


FIG. 7.—Showing fragments approximated and retained by silver plate.

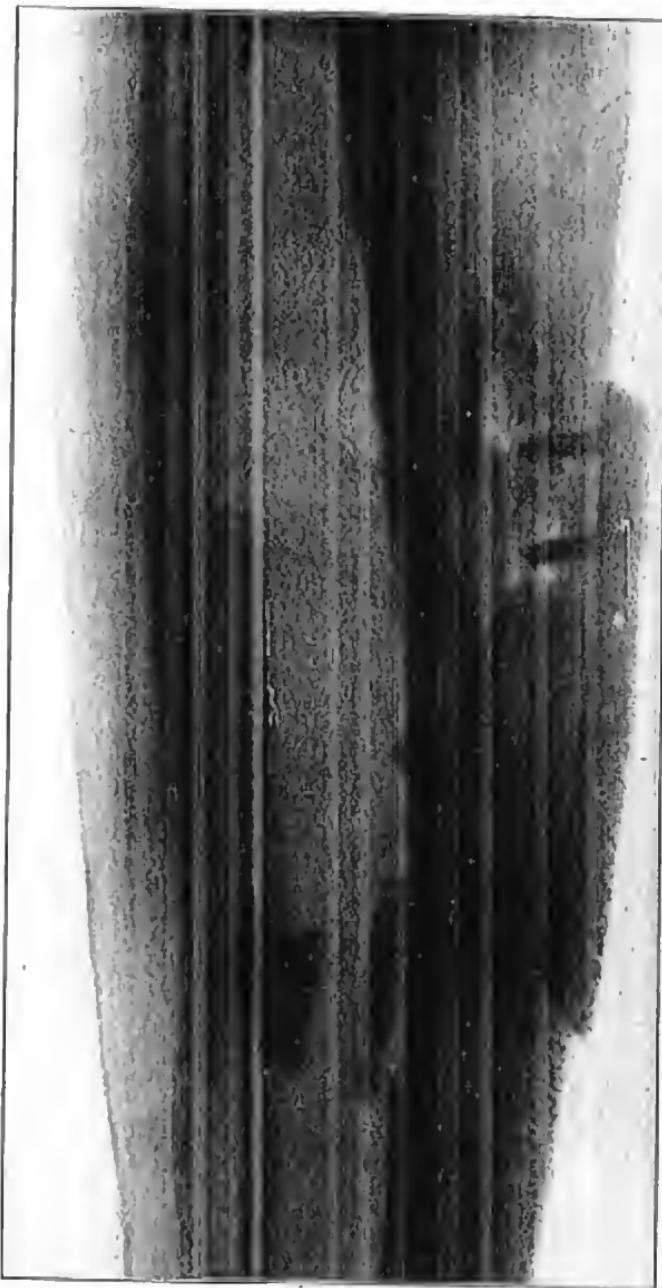


FIG. 8.—Compound comminuted fracture of tibia and fibula, showing silver plate attached.

inside of leg applied with gauze roller bandage. July 12, a small slough of integument at intersection of incision with wound, partly exposing the plate, offensive odor, slight oedema, appearance healthy, temperature normal. July 16, fenestrated plaster case applied. July 26, wound contracting, no union. Patient has delirium and hallucinations for past ten days, requiring sedatives and tying to bed. August 1, much improved, is about in a wheeling chair in daytime. August 6, rise of temperature, pus behind and below fracture, no delirium. August 22, some dark, foul pus discharging from wound, no union, fragment of necrosed bone removed, temperature of low degree, irregular, at times subnormal; incisions made postero-laterally to drain pus pockets, syringing with hydrogen dioxide and bichloride solution. September 5, no union, marked oedema of the foot, general condition good. September 19, less oedema of the foot. October 18, chill, wound discharges pus, temperature 105° F. October 31, temperature normal, some union, some purulent discharge. November 1, patient passed under the care of Dr. T. S. K. Morton. November 6, case removed, union sufficiently firm to justify it. November 22, the plate is loose from the bone, tenderness about seat of injury, temperature 102° F., several pieces of necrotic bone extracted in ether anaesthesia, removal of silver plate, curettage of exposed part of medullary cavity, an abscess cavity, not in direct communication with the wound, incised from behind, pus evacuated and drainage established. November 29, temperature normal, no pain. December 14, patient left for his home on crutches. Bones firm, no shortening of leg.

CASE III.—Mr. J. D. L., aged thirty-five years. May 14, 1899, was thrown from his carriage while driving in the park, sustained fracture of left tibia. Attended by Drs. H. and K. Fracture reduced and plaster case applied immediately. May 15, Röntgen ray photograph shows a spiral fracture of the tibia about the junction of the middle with the lower third. The case was removed, the fracture reduced, a plaster case with steel splints applied, but the fragments were found unapproximated in the skiagram which was taken. (Fig. 6.) May 18, under ether anaesthesia an incision was made over the seat of the fracture, blood clots were removed, the ends offered resistance to reduction, and forcible approximation was necessary. A silver plate was applied and secured in position with four screws. (Fig. 7.) The wound was thoroughly cleansed and closed over the plate. The leg was placed in a fracture box. May 24, the stitches were removed, temperature was always normal. June 1, slight fluctuation

above the plate, puncture and evacuation of a thin sanguinolent pus, a small gauze drainage was inserted. The plate was removed on July 6, and the patient's recovery by this time was complete.

CASE IV.—J. F. D., aged thirty-nine years. Laborer in iron works. Was admitted to the Polyelinic Hospital on July 17, 1899, suffering with a compound comminuted fracture of the tibia and fibula. On July 20, a silver plate was applied by Dr. Stern (Fig. 8), and removed on September 26, 1899. On October 18, 1899, the patient was discharged from the hospital cured.